NICKEL CREEK BRIDGE
Mount Rainier National Park
Spanning Nickel Creek on Stevens Canyon Highway
Packwood Vicinity
Lewis County
Washington

HAER No. WA-59

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
U.S. Department of the Interior
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HISTORIC AMERICAN ENGINEERING RECORD

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Mount Rainier National Park
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I. INTRODUCTION

Location:	Spanning Nickel Creek on Stevens Canyon Road, 1 mile east of Box Canyon, Mount Rainier National Park, Lewis County, Washington. Quad: Mount Rainier East, Wash. UTM: 10/604880/5179175
Date of Construction:	1951-52
Structure type:	Stone-faced reinforced concrete filled spandrel arch bridge
Fhwa Structure No.:	N/A
Designer:	Bureau of Public Roads, U.S. Department of Commerce
Contractor:	Hawkins and Armstrong, Seattle, Washington
Owner:	Mount Rainier National Park, National Park Service
Use:	Park highway bridge
Significance:	The Box Canyon and Nickel Creek bridges on the Stevens Canyon Road are holdovers or survivors of the rustic style design employed widely as early as 1920. The two stone-faced reinforced concrete spandrel arch structures echo designs employed by the National Park Service in the 1920s and 1930s. The Nickel Creek 8ridge was the last of the style constructed at Mount Rainier National Park.
Project Information:	Documentation of the Nickel Creek Bridge is part of the Mount Rainier National Park Roads and Bridges Recording Project, conducted in summer 1992 by the Historic American Engineering Record. Richard H. Quin, Historian, 1993

II. HISTORY

This is one in a series of reports prepared for the Mount Rainier National Park Roads and Bridges Recording Project. HAER No. WA-35, MOUNT RAINIER NATIONAL PARK ROADS AND BRIDGES, contains an overview history of the park roads. In addition, HAER No. WA-123, STEVENS CANYON ROAD, contains more specific information on the road on which the structure is located.

Stevens Canyon Road

The Stevens Canyon Road departs from the Nisqually Road [HAER No. WA-119] above Narada Falls, climbs to a saddle at Reflection Lakes, then drops into the Stevens Creek Canyon. The road then traverses the cliffs on the north side of the canyon down as far as the Box Canyon of the Cowlitz River. From there, the road heads generally southeast around Backbone Ridge to a junction with the East Side Road [Washington Highway 123, HAER No. WA-124]. Although the road was not completed until 1957, even much of the later work was done in the "Rustic Style," including bridges at Box Canyon [HAER No. WA-60], Nickel Creek and Stevens Creek [HAER No. WA-58], a fine stone culvert at Sunbeam Creek, two short tunnels and masonry retaining and parapet walls. The later work includes a series of reinforced concrete culverts which carry the road around steep sections of cliffs in Stevens Canyon and on the sides of Backbone Ridge, alleviating much scarring. Construction of the road began in 1931, but wartime delays postponed completion until 1957.

Nickel Creek Bridge

One mile east of the Box Canyon of the Cowlitz [see HAER reports WA-60 and WA-70 for details on developments there], the Stevens Canyon Road spans Nickel Creek on a substantial stone-faced reinforced concrete bridge. The bridge was designed in the early 1940s while work on the Stevens Canyon Road was suspended due to wartime economies. Construction began in 1950 and the structure was completed two years later. It was the last of the "rustic style" bridges constructed in Mount Rainier National Park.

The location of the Stevens Canyon Road through the Nickel Creek area was the subject of several years study. A 1928 survey conducted by J. B. Reher of the Bureau of Public Roads (BPR) offered three alternatives. One would veer north at the Muddy Fork of the Cowlitz River, avoiding the Nickel Creek valley. A second would drop down Stevens Canyon and cross Nickel Creek, then head up the stream on a series of switchbacks. The third would follow the west side of Nickel Creek to a crossing at St. Johns Fall. These routes would all then ascend the Cowlitz Ridge to invade the subalpine meadows at Indian Bar and continue east to Cayuse Pass.[1] In 1929, BPR engineer Robert N. Kellogg (formerly of the National Park Service Engineering Division) began work on a second reconnaissance survey. The new line would approach the West Fork of Nickel Creek high above the present bridge site at Nickel Creek Meadows. Kellogg was then asked to resurvey the lower part of Stevens Canyon, and reported on a line lower down the side of Stevens Canyon, crossing Nickel Creek at the present site.[2] With minor modifications, this "low line" route was tentatively adopted for the road in 1930. Following an inspection tour of the possible routes in 1931, National Park Service Director Horace M. Albright rejected any construction in the Cowlitz Divide—Indian Bar country and ordered that the road be built down the lower Stevens Canyon. Construction on the west end of the road, extending east from Inspiration Point, began in late summer 1931. In 1933, a new location survey, termed the "L"-line route, was run from the Muddy Fork crossing east to Nickel Creek and then southeast to Backbone Ridge.[3]

Orawings and specifications for the Nickel Creek Bridge were prepared at the San Francisco office of the Public Roads Administration in June 1940. Architectural plans, providing design details and special instructions for the placement of the masonry, were prepared by the National Park Service's Branch of Plans and Design, working in close cooperation with the PRA.[4] Unfortunately, not even initials appear on copies of the drawings located in the recording project, so the identity of the bridge designer was not determined.

By 1941, work on the Stevens Canyon Road was well-advanced. Construction crews working from both ends of the road completed 22 miles of road by the end of October. A half mile of road remained incomplete in the Muddy Fork area, and some other areas were only partially graded. The 8ox Canyon, Nickel Creek and bridges further east had not been built, nor had several reinforced concrete viaducts.[5]

Bonneville, Oregon contractor Sam Orino received the contract for the construction of two reinforced concrete viaducts at Stations 811+30 and 892+75 on 16 February 1941. A change order issued on 17 November provided for the construction of the Nickel Creek Bridge as part of the contract.[6]

Orino began work on structures; however, the entry of the United States into World War II forced a halt to the work. Orino was forced to suspend operations on his contract in August 1942 because of the lack of steel for bridge construction and the inability to keep skilled labor on the project. On 3 September, Orino was formally ordered by the Public Roads Administration to suspend all of his operations--Project 4C2 Unit 2 Reconstruction Grading, 4C2 Unit 3 Grading, and 4D Unit 4 Grading and Tunnel--due to the wartime shortages. Orino closed his road camp and moved out his personnel on 19 September. The viaducts were nearly complete but no work had been done on the Nickel Creek Bridge,[7] No further work was done on the Stevens Canyon Road until well after the war was concluded.

The Public Roads Administration (PRA)* did not take action on the remaining work on the park highway until 1947. However, when the agency advertised the contracts for the first phase of the work, including the Box Canyon and Nickel Creek bridges in May, no companies entered bids for the work. The projects were advertised again in the fall of 1949, and this time awards were made for the remaining work in the Box Canyon-Nickel Creek area. The bids were opened at the District 8 Office of the reconstituted Bureau of Public Roads in Portland, Oregon, on 29 November 1949. The contract for the two bridges and a viaduct at Backbone Ridge was awarded on 3 February 1950 to Hawkins and Armstrong of Seattle. Norman L. James of the Bureau of Public Roads was resident engineer.[8]

Hawkins and Armstrong established their construction camp at the Nickel Creek site on 29 May 1950. They concentrated first on the Box Canyon Bridge a mile to the west, and little work was done at Nickel Creek. A temporary timber bridge at the crossing, erected for use by construction vehicles, was repaired and used during the work. Much of early June was spent in locating good stone for the masonry, and a change order was issued to quarry stone from a different location than originally planned. The stone for the masonry was taken from rock on the right-of-way at Station 601.[9]

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* The Public Roads Administration, a branch of the Federal Works Agency, was the Depression-era successor to the Bureau of Public Roads. The BPR was reconstituted in 1949.

BPR/PRA engineers estimated the following quantities of materials would be required for the construction of the bridge. As these were only estimates, adjustments probably had to be made to suit conditions encountered on the site.

Class "A" concrete	313 cu. yds.
Masonry	258 cu. yds.
Masonry facing	168 cu. yds.
Arch ring stones	800 sq. ft.
Reinforcing steel	55,000 lbs.
Membrane waterproofing	650 sq. yds.
Structure excavation	260 cu. yds.[10]

Work on the Nickel Creek Bridge began in earnest in the 1951 season. The final construction report prepared by the Bureau of Public Roads did not offer the same level of detail on operations as earlier reports, but construction drawings, superintendent's reports, and other sources provide some information on the course of the work.

Work began with excavation for the abutments. Once these had been completed, the reinforcing steel was erected on timber reinforcement. All steel consisted of deformed bars, ranging from ½" to 1¼" in diameter; those in the arch barrel were supported on metal "chairs" or hooped stirrups. The allowable tension for the steel was 16,000 pounds per square inch. The arch ring stones or voussoirs were erected at about the same time; their shapes had been specified in the architectural plans, and the individual stones had then been cut from wooden templates. These stones were provided with 1/2" diameter hooped steel cramps to help them bond with the concrete which would be poured against them. The voussoirs were structural elements, not trim, and the concrete was poured directly against their inner face; no formwork was required for the sides of the arch.[11]

The concrete was poured next. Specifications called for the use of Class "A" concrete* mixed with a low-alkali Type II Portland cement and an air entraining admixture. The pouring schedule on the construction drawings indicates that the foundations were poured first, followed by the crown of the arch. Third came the pouring for the haunches of the arch, and fourth, construction keys between the crown and haunch sections. Two more pours provided for the tie beams and spandrel walls. The masonry facing was to be brought up to the finish line before this final pour was made; this was required because it served as the exterior formwork. The engineers' instructions dictated that the concrete in any section of the arch be allowed to cure for at least three days before an adjacent section was poured. The following concrete surfaces were to be covered with a membrane waterproofing before the compacted earth fill was placed: (1) the extrados face of the arch between the heel limits of the abutments, (2) the inside face and top edge of the spandrel walls, and (3) all surfaces of spandrel wall tie beams. The soffit face or exposed inner face of the arch barrel was to be provided with an "ordinary" concrete finish but was to be sprayed with lampblack stain.[12]

By winter shutdown on October 22 1951, all of the concrete work was finished, and the masonry walls were 80 percent complete. Construction resumed on 8 July 1952. The Box Canyon Bridge was completed late in August 1952, and the

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* Classes of concrete refer to the amount of Portland cement used in the mixture, with Class "A" having the highest proportion and so on.

contractors turned their full attention to completion of the Nickel Creek Bridge. All masonry was complete by 24 September, and final cleanup at the site was made by 23 October. Placement of sidewalks and the paving was done under a separate contract.[13]

The Nickel Creek Bridge was the last "rustic style" bridge constructed in Mount Rainier National Park. The basic design, a modern reinforced concrete structure clad in native stone, had been used at Mount Rainier since the mid 1920s, when the Paradise River Fourth Crossing and Edith Creek bridges [HAER Nos. WA-45 and WA-46] were erected on the upper end of the Nisqually Road. The bridge had been designed in 1940, while the style was being employed by the National Park Service. Later bridges, including the remaining spans on the Stevens Canyon Road to the east, were plain modern steel and reinforced concrete structures with no overt rustication or attention to detail.

Description

The Stevens Canyon Road is carried across Nickel Creek, a tributary of the Muddy Fork of the Cowlitz River, on a stone-faced reinforced concrete arch bridge constructed in the "rustic style" like many of the earlier bridges in Mount Rainier National Park. The bridge is 150' long and 33' 5" wide, and crosses Nickel Creek on a single span of 75'. The deck carries a two-lane roadway 27' wide and a 3' sidewalk on the south or downstream side only. The stones used are five or six-sided irregular granite stones with the longer face laid horizontally.

The bridge is built on a 10° spiral curve of 200' radius and rises from west to east on a 2.206 percent grade. The structure is superelevated 0.1' per foot on a radial line rising from the downstream (south) side to the upstream face. Both abutments rest on stepped concrete foundations bearing directly on bedrock. The spandrel and wing walls are constructed from broken range granite masonry, and the arch ring is constructed from large cut stone blocks cut from templates. Expansion joints are located at the juncture of the spandrel and wing walls and above the haunches of the arch. The bridge was designed for a dead load (snow load) of 150 pounds per cubic foot for the concrete and masonry; the earth fill was calculated at 100 pounds per cubic yard and 125 pounds for the top foot. The live load was listed as an AASHO H-15 rating, equivalent to 53⅓ pounds per square foot with a concentrated load of 1,500 pounds per foot of width of roadway, and no allowance for impact.[14]

The bridge's use of native granite masonry for the walls and guard rail is characteristic of "rustic style" bridge construction at Mount Rainier. The grey stone harmonizes with rock outcroppings in the vicinity, and helps the bridge integrate with its surroundings. Nickel Creek Bridge is located in a mixed conifer zone at an elevation of 2,930'.

Few park visitors take notice of the Nickel Creek Bridge. Its elegant semi-elliptical arch is viewed only by a few visitors who clamber down to the stream bed below. This is unfortunate, as a stunning view can be had of Mount Adams in the distance, framed by the bridge's arch. Cougar Falls, a fine cascade when Nickel Creek is flowing nicely, is only a short distance downstream. Most motorists notice little but the gently curved masonry parapet wall; this is what is probably so successful about rustic design, in that man-made structures harmonize with their surroundings. The graceful curve allows the bridge to seem a natural extension of the roadway.

III. ENDNOTES

1. J. B. Reher, Associate Highway Engineer, Bureau of Public Roads, "Preliminary Investigation Report on Stevens Canyon Highway, Paradise Valley to Cayuse Pass, Mount Rainier National Park, State of Washington" (Portland, OR: Bureau of Public Roads, 1928), 1-4.

2. Robert N. Kellogg, Associate Highway Engineer, Bureau of Public Roads, "Reconnaissance Survey on Stevens Canyon Project, Inspiration Point to West Fork of Nickel Creek Meadows" (Portland, OR: Bureau of Public Roads, 1930), 1-10, *passim*.

3. C. G. Polk, Assistant Highway Engineer, Bureau of Public Roads, "Final Construction Report (1935) on Stevens Canyon Highway, Mt. Rainier National Park Project PEC-4-C2, Clearing, Mt. Rainier National Park, State of Washington" (Portland, OR: Bureau of Public Roads, 1935), 2; "Final Construction Report (1931-1932-1933) on Stevens Canyon Road, Project 4-A Grading, Mt. Rainier National Park, State of Washington" (Portland, OR: Bureau of Public Roads, 1933), 2; O. A. Tomlinson, Superintendent, Mount Rainier National Park, Superintendent's Monthly Report, July 1930, 3-4. MORA Archives, Box H2621, Superintendents' Monthly Reports 1926-1932 file.

4. U.S. Department of Commerce, Bureau of Public Roads, "Nickel Creek Bridge, Stevens Canyon Highway, Sta. 462, Rainier National Park 4-D," construction drawings RG 735 A-F, 6 sheets (San Francisco, CA: Bureau of Public Roads, Western Headquarters, June 1940); U.S. Department of the Interior, National Park Service, Branch of Plans and Design, "Architectural Plans, Nickel Creek Bridge, Sta. 462+13.5—Project 4D, Mount Rainier National Park," construction drawing PG 735 A-B, 2 sheets (San Francisco, CA: National Park Service, Branch of Plans and Design, 10 June 1940). Note that the construction drawings are marked "Bureau of Public Roads," although the agency had at that point been reorganized as the Public Roads Administration. This seems to indicate that the drawings after the BPR was reconstituted.

5. George B. Forrest, "Final Construction Report, Stevens Canyon Highway, Mt. Rainier National Park Highway Project 4-D, Unit 2, 4-E2, Unit 1 (Pors.) and 4-D, Unit 3, Reconstruction Grading and Grading, Lewis County, Washington" (Portland, OR: Public Roads Administration, 20 June 1942), 1-4, App. 1.

6. N. L. James, Resident Engineer, Bureau of Public Roads, "Final Construction Report, Stevens Canyon Highway, Mt. Rainier National Park Project 4-D and 4-E2, Units 1 and 2, Bridges and Viaducts, Mt. Rainier National Park, Lewis County, Washington" (Portland, OR: Bureau of Public Roads, 4 March 1954), 2.

7. *Ibid.*, 2-3; John C. Preston, Superintendent, Mount Rainier National Park, Superintendent's Monthly Report, August 1942, 3; Superintendent's Monthly Report, November 1942, 3. MORA Archives, Box H2621, Superintendents' Monthly Reports 1940-1946 file.

8. Preston, Superintendent's Monthly Report, March 1947, 2; Superintendent's Monthly Report, June 1947, 2. MORA Archives, Box H2621, Superintendents' Monthly Reports 1947-1952 file; Superintendent's Annual Report, 1947, 7; Superintendent's Annual Report, 1950, 7. MORA Archives, Box H2621, Superintendents' Annual Reports 1941-1953 file; W. H. Lynch, Division Engineer, Bureau of Public Roads, Portland, OR, to Preston, 10 November 1949. MORA Archives, Roads and Trails Box 1; Sanford Hill, Assistant Regional Director, National Park Service Region Four, San Francisco, CA, to Lynch, 30 October 1952, in James, Appendix B.

9. James, 2.

10. See estimates table on BPR construction drawing RG 735-A.

11. See BPR/PRA construction drawings RG 735-A and B.

12. See the pouring schedule on BPR/PRA construction drawing RG 735-A, and "General Notes" on BPR/PRA construction drawing RG 735-B.

13. Curtis K. Skinner, Acting Superintendent, Mount Rainier National Park, Superintendent's Monthly Report, August 1952, 4; Preston P. Macy, Superintendent, Mount Rainier National Park, Superintendent's Monthly Report, September 1952, 3. MORA Archives, Box H2621, Superintendents' Monthly Reports 1947-1952 file.

14. See "General Notes," *op cit.*

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Hill, Sanford, Assistant Regional Director, National Park Service Region Four, San Francisco, CA, to W. H. Lynch, Division Engineer, Bureau of Public Roads Division 8, Portland, OR, 30 October 1952.

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